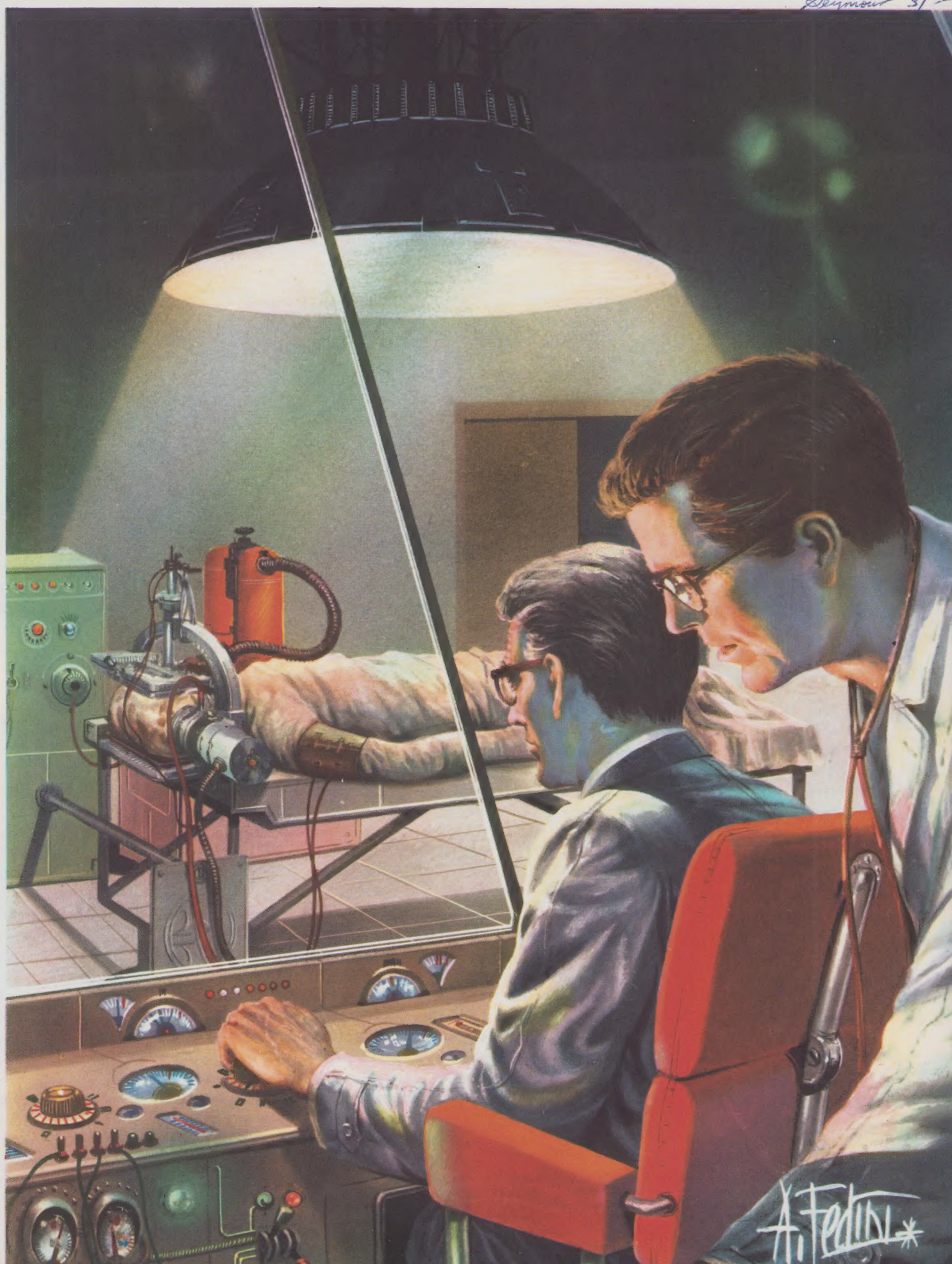


KNOWLEDGE

NO. 184 VOLUME 16 The colour magazine which grows into an encyclopaedia EVERY MONDAY 2/-



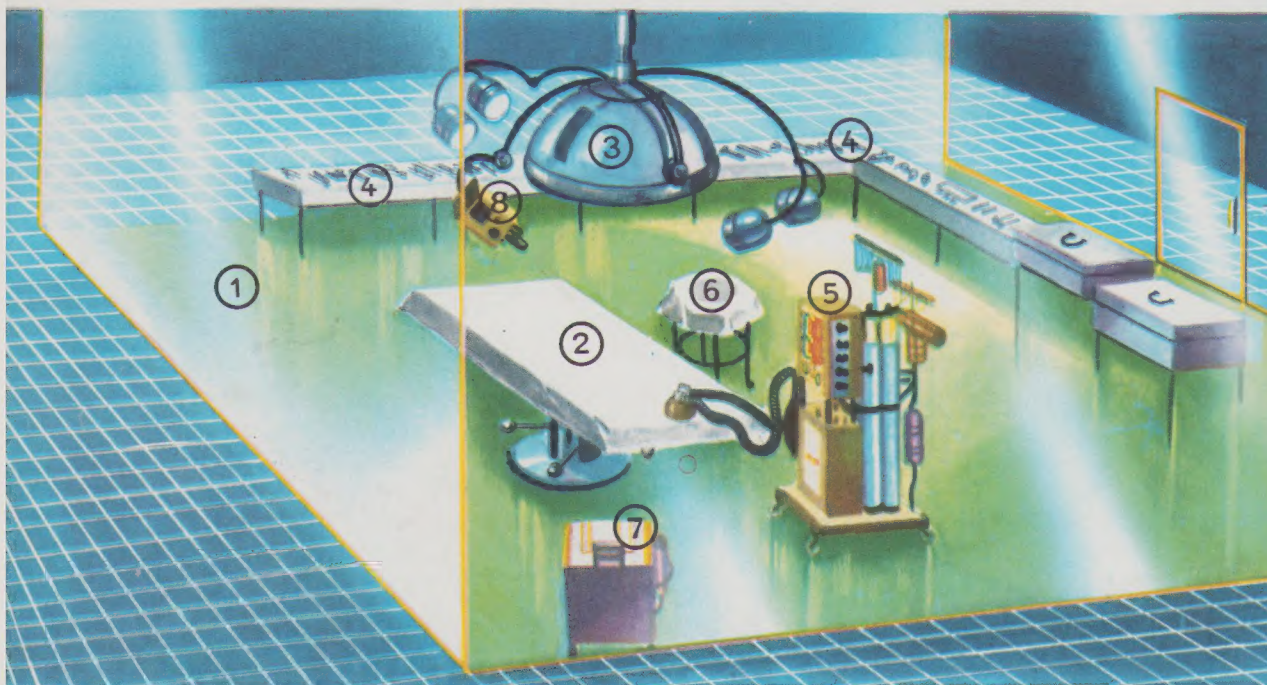
*Lady Violet Bonham Carter, D.B.E., Prof. C. N. L. Brooke, M.A., Mr. Norman Fisher, M.A.,
Advisory Editorial Board Mr. Walter Hamilton, M.A., Mr. John Sparrow, M.A., Dr. Dudley Stamp, C.B.E., D.Sc.,
Sir George Thomson, F.R.S., D.Sc.*

Editor-in-chief: John Chancellor, M.A.

Editor: William Armstrong, M.A.; Assistant Editor: Christopher Falkus, B.A.

Editorial address: 37 Hertford St., London W.1.

S SURGERY



SURGERY is handiwork – a very special handiwork which is carried out on the organs of the human body. It is performed by *surgeons*, whose purpose it is to cure illness by repairing, removing, or even by replacing damaged or diseased body organs.

A few relatively simple surgical operations have been known and practised for thousands of years, but before anaesthetics were developed surgery was limited by the intolerable pain which the patients suffered. Major operations were almost unknown except for amputations necessitated either by war or accident.

In the year 1842, however, Crawford Williamson Long, physician and surgeon of Jefferson County, Georgia, administered ether to a small boy before cutting out a tumour from his neck. The child was unconscious throughout the operation, and as a result he felt no pain. A new era in surgery had begun.

Today painless surgery is the rule. The surgeon, anaesthetist, and nurses work together in elaborate operating theatres which are wonderfully and expensively equipped to ensure the successful outcome of every operation.

① A glass screen which divides the part of the operating theatre where the operations are performed from the surrounding area used for the preparation of instruments, dressings, and so on.

② The operating table – its height and tilt can be adjusted to the surgeon's requirements by the controls beneath it.

③ The theatre lamp, specially designed to illuminate without casting shadows.

④ Tables on which instruments are kept. The instruments required for each operation are sterilised before use and then placed on trolleys which can be wheeled up to the operating table.

⑤ The anaesthetic apparatus – this can be moved about so that it does not get in the way of the surgeon.

⑥ A receiver for used swabs.

⑦ The desk on which the surgeon keeps the patient's notes. At the end of each operation he, or his assistant, records in the notes the details of the operation which they have performed.

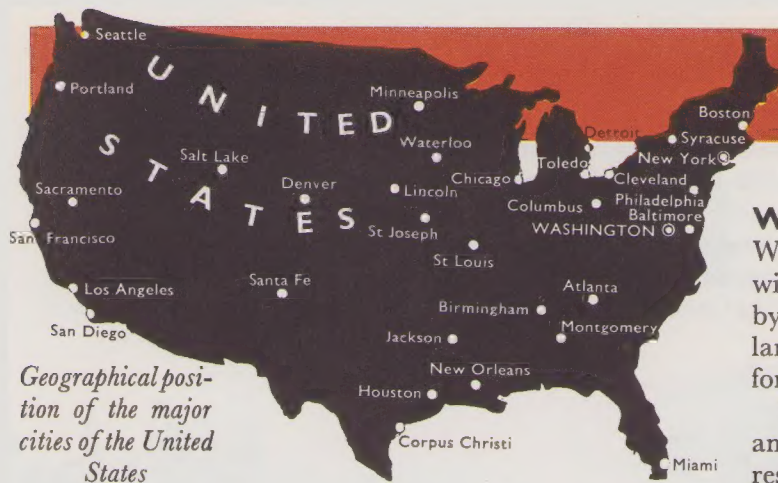
⑧ A television camera. In medical schools, closed-circuit colour television is sometimes used so that large numbers of students can see every detail of the surgeon's technique.



The surgeon's clothes

The purpose of the highly specialised clothes worn by the surgeon and the rest of the staff in the operating theatre is to prevent the germs which normally live on people's skin and in their hair and their respiratory passages from getting into the patient's wound, where they might cause a dangerous infection. All the clothes, with the exception of the white boots, are sterilised in an *auto-clave* before they are put on, and the surgeon changes his gown and his gloves between each operation. By so doing he makes sure that he does not transfer germs from one patient to the next. He does not usually change his cap and mask.

Previous page: a surgeon watches the physicist control from long range a proton knife. This device, which discharges a beam of protons, has been used in treating the brains of patients suffering from a form of paralysis known as Parkinson's Disease.



Geographical position of the major cities of the United States

ALTHOUGH the United States is a vast country with large areas of semi-wilderness, its people are primarily city dwellers; despite the fact that each year American farmers consistently produce enormous agricultural surpluses, it is nevertheless an industrial nation. With its rich natural resources and plentiful power supplies, the United States has had every reason to become a great manufacturing country. And as its industries developed, improved machinery enabled its farmers to produce more and more crops with fewer and fewer workers. As a result, Americans have tended to crowd together in the cities, which get bigger and bigger every year.

This tendency is likely to continue in the future, and some authorities predict that before long the densely populated Eastern Seaboard (the Atlantic coast) will be one immense city, or 'megalopolis', stretching from Maine to Florida.

As American city-dwellers become more prosperous they tend to move out to suburban districts. This means that the so-called 'downtown' areas of American cities are either purely business districts or are occupied by very poor people. This problem has been worrying American planning authorities for some years, and every effort is now being made to encourage the commuters to return to the cities to live.

Because of the mass production of American goods, the influence of advertising, and Americans' desire to be as like each other as possible, most large cities in the United States look alike. There are, of course, some exceptions, like San Francisco and New Orleans, but on the whole they do not differ substantially.

An American city can be of any size. The largest is New York (see page 982), with 7,781,984 inhabitants, while the smallest is Meteor City in Arizona, which advertises a population of two.

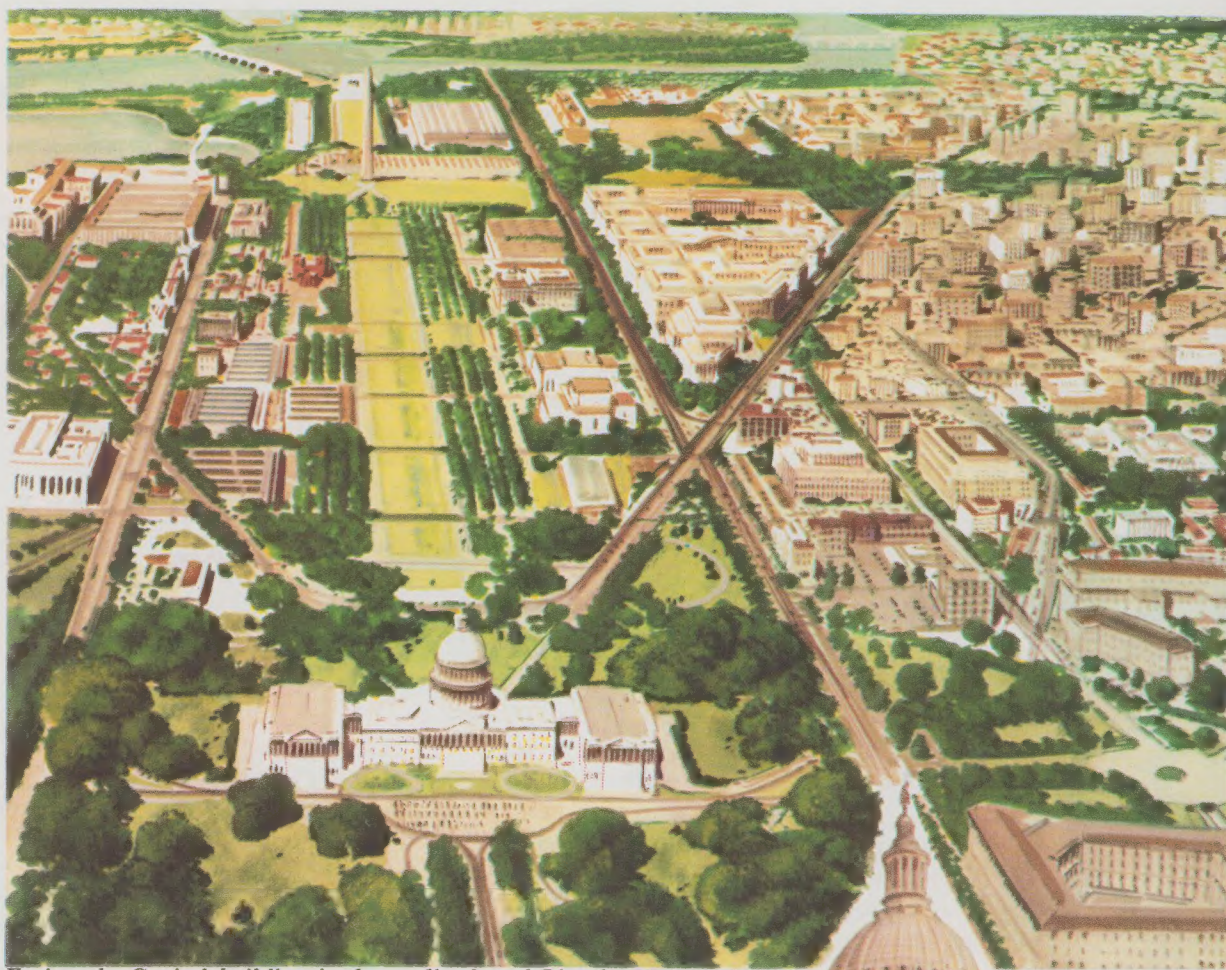
CITIES OF THE USA

Washington, the capital

Washington, the capital city of the United States of America, lies within the District of Columbia on Federal land. The site was chosen by George Washington, and the land was given by the states of Maryland and Virginia – thus ending the rivalry between North and South for the capital.

The city of Washington was originally planned by Pierre L'Enfant and Andrew Ellicott; work began on the White House, the President's residence, in 1792, and on the Capitol, the seat of government, the year after. The first session of Congress to be held in Washington took place in 1800. The British captured Washington in the war of 1812, however, and the White House, the Capitol, and many of the public buildings were burned.

Washington is laid out in the form of a rectangular pattern of streets overlaid with the wheel-like spokes of wide avenues radiating outwards from the Capitol.

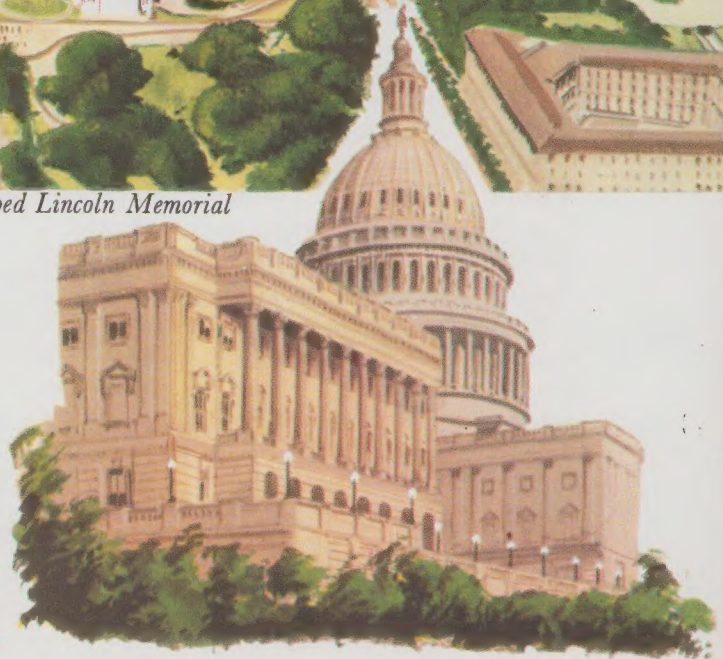


Facing the Capitol building is the needle-shaped Lincoln Memorial

Only part of the original gracious and imaginative plan was carried out, but Washington is still spacious and dignified, with many large, neo-classical public buildings. It is famous for its Japanese flowering cherry trees.

The city has a population of 763,956 and covers 70 square miles. More than half the people are Negroes, many of whom live in appalling slums which contrast with the rest of Washington.

The Capitol, the seat of government ▶



CHICAGO: 'HOG BUTCHER FOR THE WORLD'

Chicago, on Lake Michigan, is the second largest city in the United States, and has 3,550,404 inhabitants. It is the world's greatest railway junction, as well as being a major road and air centre. It has the world's largest grain and live-stock markets and meat-packing industry. It is also the financial and industrial centre of the whole Midwest of the United States.

Carl Sandburg, the world-famous poet from Chicago, described his city as:

*'Hog Butcher for the World,
Tool Maker, Stacker of Wheat,
Player with Railroads and the
Nation's Freight Handler.'*

Chicago is often called the 'Windy City', because of the stiff breezes which habitually blow off Lake Michigan. Temperatures vary greatly: a fall of 20°F within 24 hours is fairly common, and a drop of 30°F is not unknown. The city grew up at the mouth of a shallow stream, the Chicago River, and possibly takes its name from the Indian *she-kag-ong*, meaning wild onion place. The first white men to visit the river were Father Marquette and Louis Jolliet in 1673; it soon became an important trading route. A trading post and fort grew up at its mouth, and in 1831 the small village of Chicago was made the seat of justice for Cook County. By 1837 it was large enough to become a city.

In 1871 a disastrous fire swept through Chicago, burning its old wooden houses, and it was rebuilt of stone and steel. It grew rapidly as an industrial centre and market for the surrounding region. Successive waves of European immigrants arrived there, and the population now includes many people of Polish, German, Scandinavian, Italian, and Irish extraction.

PHILADELPHIA: QUAKER CITY

The city of Philadelphia was founded in the late 17th century by the Quaker colonist William Penn, who planned it partly as a refuge for persecuted peoples and gave it its name, which means brotherly love. The Quakers built up a thriving trade and shipbuilding industry, and Philadelphia became a large and important city. It was capital of the American colonies during most of the Revolution (except for nine months when it was in British hands), and capital of the new republic from 1790 until 1800, before its replacement by Washington. It has been a cultural centre and industrial city since early in the 19th century.

Philadelphia is now the fourth largest city in the United States, with 2,002,512 people. It is one of the country's chief ports and a major industrial, commercial, and educational centre. This somewhat conservative city contains such historical sites as Independence Hall (where the Declaration of Independence was signed in 1776), Carpenters' Hall (where the first Continental Congress met), and Betsy Ross House (where, according to tradition, the first American flag was made).

LOS ANGELES

In 1781 El Pueblo Nuestra Señora la Reina de los Angeles de Porziuncola (the town of Our Lady Queen of the Angels of Porziuncola) was founded on the site of an Indian village called *Yang-na*. It became a Spanish and Mexican cattle-ranching centre, and was incorporated as an American city in 1850. Los Angeles started to grow rapidly in the 1890s with the discovery of oil, and further impetus was given to its expansion by the establishment of the motion-picture and aircraft industries in the 20th century. Los Angeles now embraces many separate communities, among them Hollywood, Beverly Hills, and Culver City. It is the third largest city in the United States (population 2,479,015).



DETROIT - CAR CAPITAL OF THE WORLD

Detroit, the fifth largest city in the United States, is internationally famous as the centre of the huge American car industry; about 75 per cent of its industrial production consists of cars and car parts. It is the hub of an enormous industrial and metropolitan area, and has a population of 1,670,144 – half the population of the state of Michigan.

Founded in 1701 by Antoine de la Mothe Cadillac as a French settlement, Detroit became British in 1760, American in 1796, British in the war of 1812, and finally American in 1813.

BALTIMORE

Baltimore was first settled in the early 17th century, and became a chartered port in 1729. It soon became a colonial shipping centre for grain and tobacco. During the war of 1812 the Americans' gallant defence of Fort McHenry at the harbour entrance inspired Francis Scott Key to write *The Star-spangled Banner*, the American National Anthem. The city had to be put under martial law during the Civil War because its citizens were so violently divided in their sympathies between North and South. Baltimore is now the sixth largest American city with a population of 939,024, and is a major seaport, and a shipbuilding and industrial centre.

New York's famed Empire State Building

The Penobscot Building, a Detroit skyscraper

Philadelphia's City Hall

A view of Boston, Massachusetts

Skyscrapers line Michigan Avenue, one of Chicago's main streets

A view of Baltimore, Maryland

The White House in Washington, home of the President

Bridges cross the Mississippi at Saint Louis

Edgewood Avenue in Atlanta, Georgia

The financial sector of New Orleans

Hotels in Miami, Florida

CLEVELAND

Cleveland, in Ohio, is the seventh largest city in the United States and a major Great Lakes port. Iron ore is unloaded here for the city's large steel industry and other Ohio and Pennsylvania steel towns. The city's steel mills are amongst the largest in the world, but it has many other industries, notably those connected with railways, oil, and electrical products.

Cleveland was laid out by Moses Cleaveland in 1796 and chartered as a city in 1836. It grew prosperous in the Civil War by supplying iron products and clothing to the Federal states.

SAN FRANCISCO

San Francisco is perhaps the most beautiful of all American cities. It is the main port and financial centre of the Pacific coast and has a population of 742,855.

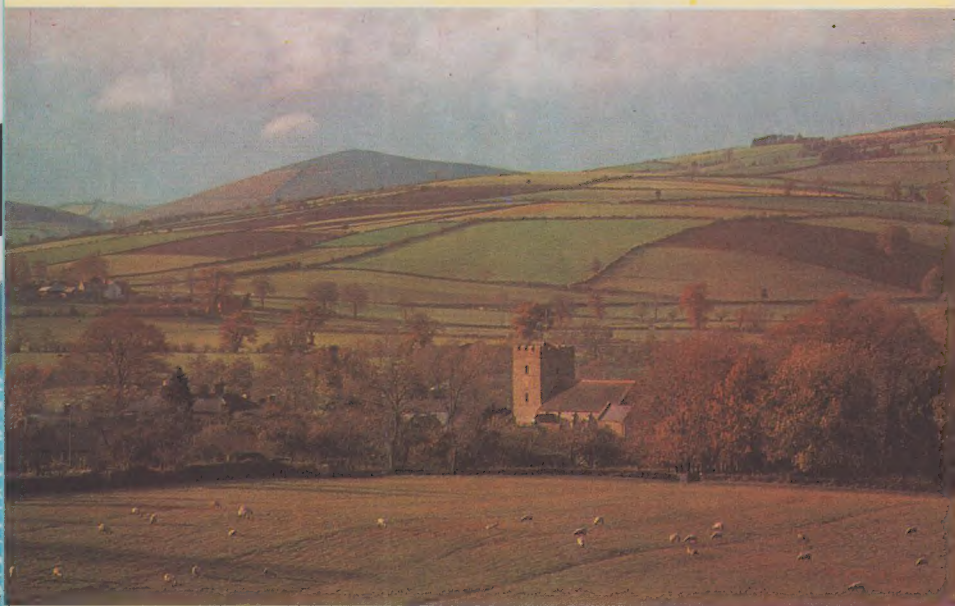
San Francisco has an even climate with an average temperature range of 50–62°F. It is famous for its cable cars and the Golden Gate Bridge, and has the largest Chinese community outside the Far East. It is built over a number of hills, and in some streets the gradient is so steep that cars have to be parked at right angles to the pavement.

San Francisco was the place where the United Nations Charter was signed in 1945 and the peace treaty with Japan in 1951.

HOUSTON – PETROLEUM CITY

The largest city in Texas, Houston (population 938,219) is also one of the United States' greatest cargo ports. It is an important chemical manufacturing centre, its wealth being derived from natural resources such as oil, natural gas, sulphur, and salt. The 50-mile-long Houston Ship Channel, dredged in 1912 and 1913, connects the city to the Gulf of Mexico. Between 1837 and 1839 Houston was the capital of the Texas Republic. Its development was spurred first by the dredging of the Ship Channel and the exploitation of the Gulf Coast oil fields, and later, during the Second World War, by the expansion of the war industries.

HEREFORDSHIRE, SHROPSHIRE, AND CHESHIRE



Shropshire, near Clun – the district described by the poet A. E. Housman as 'The country for easy livers, the quietest under the sun'

ALONG England's border with Wales lie the counties of Herefordshire, Shropshire, and Cheshire. Welsh influence is strong here; it is shown in place-names like Llan-y-Blodwell, Llanymynech, and Llandinabo with its church dedicated to the Welsh Saint Dinebo. The sing-song intonation of the Welsh is heard in addition to the softer, slower voices of the Englishmen, and as recently as 1855 a clerk to the Hereford magistrates was given his job because he was able to speak Welsh. Today English and Welsh live peacefully side by side, but for centuries their fighting ravaged the quiet countryside.

The appearance of the counties

The physical structure of these counties is very complicated, but basically they consist of a plain extending from the river Mersey on the northern boundary of Cheshire south to Shrewsbury with a few isolated hills like the Wrekin, and hills from Shrewsbury to the central, hill-encircled plain of Hereford in the south. The Pennines and their foothills lie to the north-east and the Malvern Hills to the south-east, while the mountains of Wales rise to the west.

Many rivers run across these counties. The Wye flows through Herefordshire from north-west to south-east, and the Severn crosses Shropshire in much the same direction. The river Weaver flows northwards through Cheshire to the great river Mersey which forms the county's northern border. Between the Mersey estuary and that of the river Dee to the west is the curiously-shaped Wirral peninsula. These rivers and their tributaries dissect the hills and in many cases provide trout and salmon fishing.

The pattern of the countryside is typical of an agricultural area, with villages, small market towns, and one central town in each region. Hereford is very much larger than any other town in Herefordshire, having a population of 42,430 compared with the 6,530 of Leominster, the next largest town. Shrewsbury, similarly, is much larger than any other town in the county of Shropshire. In Cheshire, however, the pattern was disturbed by the growth of industry in the 19th century, and Birkenhead and Stockport are well over twice as large as Chester, while Crewe, in southern Cheshire, is one of England's main railway junctions.

All three counties have outstanding examples of half-timbered houses. In this part of England the wooden beams are stained black and the surface between is painted a dazzling white. Little Moreton Hall in Cheshire, the village of Weobley in Herefordshire, and

Pitchford in Shropshire are particularly fine, although it is difficult to give only a few examples when the whole region is so rich in lovely buildings.

A little history

It would take a whole article to give even an outline of the fascinating and often bloodstained history of these border counties, which were for centuries a battleground. Evidence of the troubled times can still be seen in the fortress towns in which the Roman troops were garrisoned, like Viroconium and Deva (now Chester); Offa's great dyke (see page 334) which the Anglo-Saxons built to keep out Welsh invaders; the large numbers of Norman castles; and the fortified manor houses like the beautiful 13th-century Stokesay, part of which is illustrated on page 1942.

Welsh raiders constantly harassed the Saxons, and in 1055 they attacked Hereford, destroying the Saxon cathedral and killing several monks. So Edward the Confessor sent his nephew Harold (later to become king) to build a wall round the city, part of which can still be seen.





A magnificent example of the traditional 'magpie' houses of the Anglo-Welsh border counties: Little Moreton Hall, Cheshire

When the Normans had subdued the region they built a chain of great castles to defend the land against the Welsh – among them: Ewyas Harold, Hereford, and Weobley in Herefordshire; Shrewsbury, Ludlow, and Whittington (built around a Saxon stronghold) in Shropshire; and Halton and Beeston in Cheshire. Chester held out longer than any other English city against William the Conqueror, and when he had captured it he gave it, with as much land around as he could win from the Welsh, to his nephew as a County Palatine – a county whose ruler owed allegiance only to the sovereign and was not subject to the common laws of the country.

Because of the immense strategic importance of these border counties, their lords acquired tremendous privileges from the English kings to help them in their task of subduing the Welsh. Their domains were known as Marcher Lordships, and the Crown had virtually no jurisdiction over them. Some of the Marcher Lords became dangerously powerful – among them the Mortimers. In 1327 Roger Mortimer, Earl of March, was instrumental in the deposition and murder of Edward II, and for three years Roger Mortimer was the virtual ruler of the country. This Mortimer did not become king, but about a century and a half later Edward, 7th Earl of March and a Mortimer on his mother's side, led the Yorkists to victory over the Lancastrians at the battle of Mortimer's Cross near Aymestry in 1461. A few weeks later he was crowned King Edward IV.

The kings of England have played a large part in the colourful history of these three counties. After the battle of Lewes in 1264 (see page 1956) Henry III and his son Edward were imprisoned in Hereford Castle; Edward managed to escape from their guards and rally support for their cause. Later, as Edward I, he made Chester his headquarters while he subdued Wales. Edward III was created Earl of Chester – a title held by the heir apparent ever since.

In the Civil War, too, the Welsh border counties saw a full share of the fighting, and after the Royalists were defeated at the battle of Worcester in 1651 Charles II fled to the woods round Boscabel, where he is said to have hidden in an oak tree before taking refuge at Boscabel House.

The growth of industry

In the late 17th century Abraham Darby founded the Coalbrookdale Iron Company beside the Severn. This was the cradle of the modern iron industry; here iron was first smelted with coke, iron rails were first used, cast-iron cylinders for steam engines were first made, and the first iron boat was launched. Nearby, at Ironbridge, is the oldest iron bridge in England.

In the 19th century industry developed in Cheshire, so that large towns grew up along its northern limits. Salt, which had been mined since before the coming of the Romans, formed the basis of the chemical industry which is flourishing there today. At Port Sunlight on the Mersey are great soap factories, and Birkenhead has busy docks, huge oil storage tanks, corn warehouses, and flour mills. Silk is manufactured at Macclesfield, and there are cotton mills at Stockport, Stalybridge, and other towns. But there is little industry in Herefordshire and Shropshire, except for such rural industries as cider-making, brewing, and milling flour.

Agriculture

The counties of the Welsh border are, above all, agricultural, and crops include oats, wheat, barley, sugar beet, and potatoes. More than four-fifths of Herefordshire are under cultivation; it is famous for its pear and apple orchards and for hops, production of which is second only to that of Kent. The name of Hereford has been made world-famous by the Hereford beef cattle, whose reddish-brown coats and benevolent white faces are seen in places as far away as Australia and Argentina. Hereford itself has an important livestock market.

Shropshire has won renown – though on a smaller scale – for the Clun Forest sheep, called after the hilly region in the western tip of the county. Hereford cattle are reared in south Shropshire, but farther north dairy cattle, including shorthorns and Friesians, greatly outnumber beef cattle, and in southern Cheshire their milk is still used for making the traditional Cheshire cheese.

And so today these once battle-scarred counties are peaceful farmland. The ancient fortresses are crumbling; the old traditions are dying out; even the dialects are gradually being infiltrated with 'standard English'. But it would be difficult ever to wipe out the fascination of this lovely and historic region.

The river Wye, as it flows through the green and fertile hills in the south of Herefordshire



L O R D J O H N R U S S E L L

LORD JOHN RUSSELL was by no means the most spectacular British statesman in the 19th century, but he was one of the most important. He was at the centre of political life from the last years of Castlereagh (see page 2620) until the first ministry of Gladstone (see page 1636). His career spanned the vital years which saw the growth of democracy in Britain and a major change in the political system.

Russell was born on 18th August 1792. He was a sickly child, so he never went to school for only one year; after that he was educated privately before going to Edinburgh University. In 1813 he became Member of Parliament for the family borough of Tavistock. He was a Whig, and supported the 'liberal' opposition to the Tory government which was dominated by Castlereagh. Lord Russell became particularly interested in parliamentary reform and introduced his first motion in favour of it in 1819. He was largely responsible for the disenfranchisement of Grampound in Cornwall in 1821 (see **The Great Reform Bill**, page 1786), and brought the question of reform before the House of Commons almost annually. He also identified himself with other liberal measures: the repeal of the Test and Corporation Acts (repealed by Wellington in 1828) and the question of Catholic Emancipation (granted in 1829).

1830 was a significant year in both the history of England and the career of Lord John. The Tories were defeated, and Lord Grey became Prime Minister. Russell, who was made Paymaster of the Forces, was not included in the Cabinet, but he was one of the four ministers chosen to frame the Great Reform Bill, which was passed in June 1832. Two years later King William IV dismissed Lord Melbourne, who had succeeded Grey, and Russell also left office. But in March 1835 Russell succeeded in defeating the Tories over the question of applying the surplus revenues of the Irish Church to education. At the general election that followed, the recently-widened electorate returned the Whigs. This was clear evidence that the King could no longer pick and choose his ministers, nor rely on his influence for a majority in the Commons.

Lord John was now Home Secretary and Leader of the Commons, and one of the most influential statesmen of the time. He had much to do with the Municipal Reform Act (1835).

and the Tithes Commutation Act (1836). In 1839 he was transferred to the Colonial Office, and in 1841 he introduced a proposal full of future significance: he proposed a fixed duty on corn at eight shillings a quarter and a reduction in the duties on sugar and timber. This measure was defeated in Parliament, and a general election rejected Melbourne and returned Robert Peel. Russell himself was returned by the City of London, and for the next five years he campaigned eloquently on behalf of freer trade.

During Peel's ministry Russell was the Leader of the Opposition and was clearly destined to be the next Whig Prime Minister. But his premiership came sooner than was anticipated. The reason was the Irish potato famine (see page 2601) of 1846; in this crisis Russell announced his support of the immediate repeal of the Corn Laws. Peel resigned to allow Russell to form a 'repeal' ministry, but he was unable to do so. Peel resumed office and, with Russell's support, repealed the Corn Laws. Shortly afterwards Peel was defeated on an Irish coercion bill, and Russell became Prime Minister.

Russell as premier

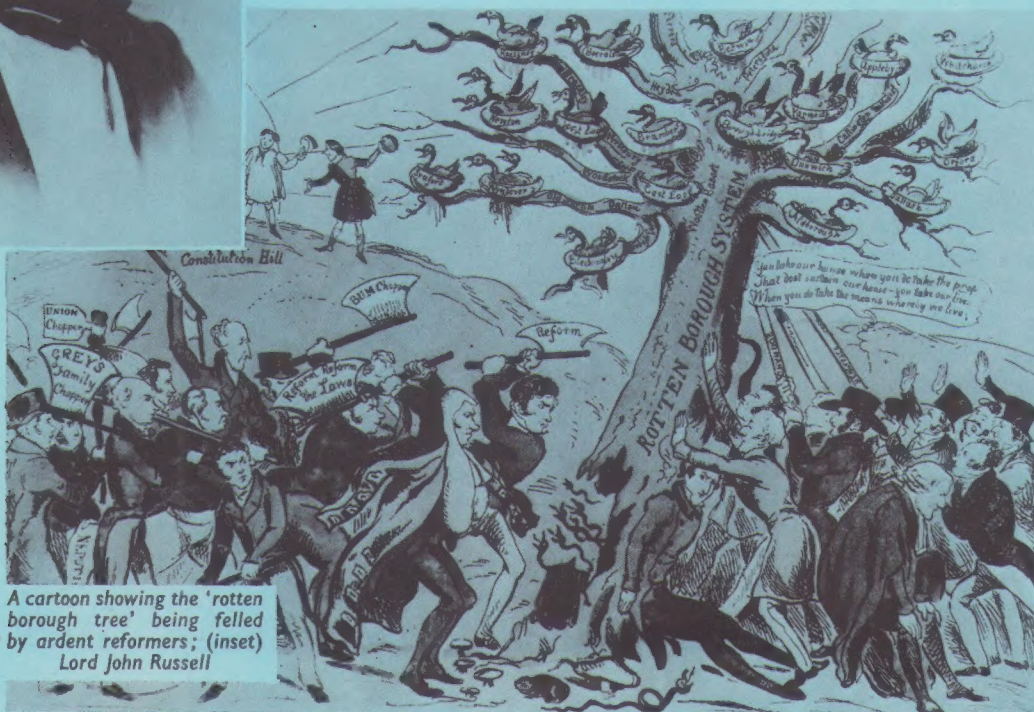
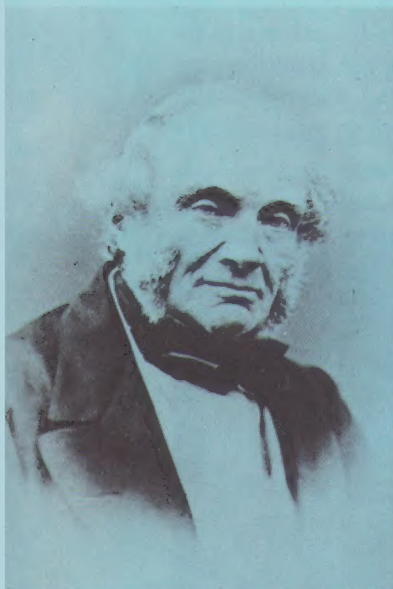
Russell was not a very successful Prime Minister. He failed to prevent the terrible hardships of the Irish famine, although his refusal to panic had much to do with the collapse of the Chartist movement after 1848. In the field of foreign affairs he was dominated by his headstrong colleague Lord Palmerston (see page 2540), whose high-handed methods led to his own dismissal by Queen Victoria in 1852. Palmerston immediately defeated his former chief on a militia bill; after a short-lived ministry under Lord Derby, Lord Aberdeen – a 'Peelite' – formed a coalition, with Russell as Leader of the Commons, and Foreign Secretary for the first few weeks.

There followed a period of humiliation and unpopularity for Russell. He became preoccupied with a new parliamentary reform bill, but, with the Crimean War raging, the Commons did not want to waste time on such matters as franchise reform. In 1855 Russell resigned when he felt unable to oppose a motion of censure on the government's war policy. His action was condemned as purely selfish by, among others, Queen Victoria. Indeed, it is quite likely that he was increasingly angered by the lack of interest shown in his reform proposals by his colleagues.

Russell declined to serve under Lord Palmerston, who replaced Aberdeen in 1855, but became Britain's representative in the peace negotiations. His proposals were rejected, and for four years he was without office. In 1859 Russell at last agreed to serve under Palmerston, provided that he could have the Foreign Office. With Palmerston's approval, he did much for the cause of Italian unity in 1859 and 1860. But his failure to prevent the *Alabama* from sailing from Britain to damage 'Yankee' shipping in the American Civil War was a costly mistake.

When Palmerston died in 1865 Russell became Prime Minister for the second time but resigned the following year when his reform bill was rejected. In 1868 he felt too old to join the Gladstone administration. He died in 1878.

Lord Russell was not a great statesman: he could not turn his mind from a fixed set of principles to more necessary matters. But his unswerving devotion to those Whig principles give him a secure place in the history of 19th-century Britain.



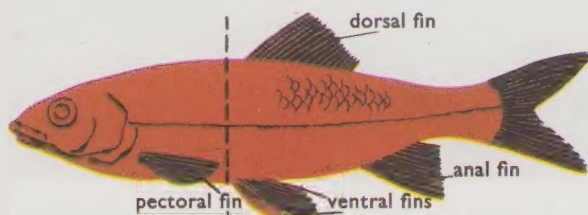
A cartoon showing the 'rotten borough tree' being felled by ardent reformers; (inset) Lord John Russell



A scene of bloodshed in a South American river: an ox is attacked by savage piranha fish

THE CYPRINIFORMES

EVERYONE knows of the danger of sharks in tropical and subtropical seas, but swimming is generally safe in rivers far inland – generally, but not always, for in the rivers of tropical South America there are fish that will attack man or beast with terrifying ferocity. They are called piranha (pronounced ‘piranya’); and, although they are not large, they have jaws and teeth that can bite off a man’s finger or take a piece of flesh right out of his leg, and a shoal can easily kill a man. Piranha are particularly likely to attack anyone who already has a cut or sore that will taint the water. It is hard to believe that the dangerous piranha belong to the same great Order of fishes as the goldfish in garden ponds.



Arrangement of the fins in a Cypriniform fish

Common characteristics

The most important characteristic common to all the Cypriniform fishes is the possession of a chain of three or four little bones on each side connecting the swimbladder with the internal ear. These are called the *Weberian ossicles* after Professor Weber, the

Dutch zoologist who discovered them. The function of this apparatus is not fully understood, but it probably helps the fish to detect small alterations in pressure in the water. These ossicles or ‘little bones’ are also found in the catfishes or Siluroidea. The Cypriniform fishes also have their hinder paired fins (*ventrals*) placed well behind their front paired fins (*pectorals*).

A fish that can light a lamp

One curious Cypriniform fish, the electric eel, produces an electric discharge. An eel about 3 feet long may produce a discharge of over 600 volts. The amperage is low – about one-half to three-quarters of an ampere – so the shock is not generally lethal to a man or a large animal. The amperage (but not the voltage) increases with the size of the fish, which may grow to over 9 feet. No observations have been made on the electric potential of such large specimens, but we must assume that they are dangerous.

The electric organs lie along each side of the fish and account for nearly half of its weight; they consist of alternating plates of muscle and connective tissue. The charge, which is always positive towards the head of the fish and negative towards its tail, can be demonstrated with a volt meter or with a lamp (as shown in the picture on the right) which lights up momentarily. The discharge is used by the fish both as a defensive weapon and to stun the small fishes on which it preys.

AN ENORMOUS ORDER

The Order Cypriniformes includes most fresh-water fishes. Carps and loaches (Cyprinidae) are found in most parts of the Northern Hemisphere. Characins (Characinidae) inhabit Africa and South America, and the Gymnotidae or electric eels are South American.

Some members of this Order are of economic importance and others give sport to fresh-water anglers, especially in Europe and North America.



Demonstration of the current produced by an electric eel

FAMILY CYPRINIDAE

Common carp (*Cyprinus carpio*). A fish of still waters which does very well in ornamental ponds and pools that are not too small. Carp grow to a large size under favourable conditions, reaching 60 pounds in weight. This fish is a native of continental Europe and is believed to have been introduced into Britain in the 16th century.

Tench (*Tinca tinca*). The tench is seldom seen because it lives at the bottom of still or slowly flowing waters, seeking its food in the mud. In Britain it is common in the Norfolk Broads.

Chub (*Squalius cephalus*). Clear, swiftly flowing rivers are the home of the chub or chavender, and it can be caught on rod and line with almost any bait. It is useless to take chub home, however, because the flesh is full of little bones and almost inedible.

Bleak (*Alburnus alburnus*). A pretty little fish, bright silvery in colour and about 8 inches long when fully grown. A preparation made from its scales is used in the manufacture of artificial pearls.

Barbel (*Barbus barbus*). Rather like a carp, but more slender, with two pairs of fleshy barbs or 'whiskers' on the mouth. This is a river fish, found in Britain mainly in the Thames and Trent. Barbel are great favourites with anglers because of their fighting qualities, but they are not good eating.

Gudgeon (*Gobio gobio*). A small fish, usually about 6 inches long, that lives in rivers. Unlike most of the carp family, it is good to eat.

Minnow (*Phoxinus phoxinus*). One of the smallest of the carp family, usually about 3 inches long. It lives in rivers.

Rasbora (*Rasbora heteromorpha*). A little tropical fish from the streams of Malaya and Indonesia. There are many species of the genus *Rasbora*; this is one of the prettiest, and a great favourite with aquarium keepers.

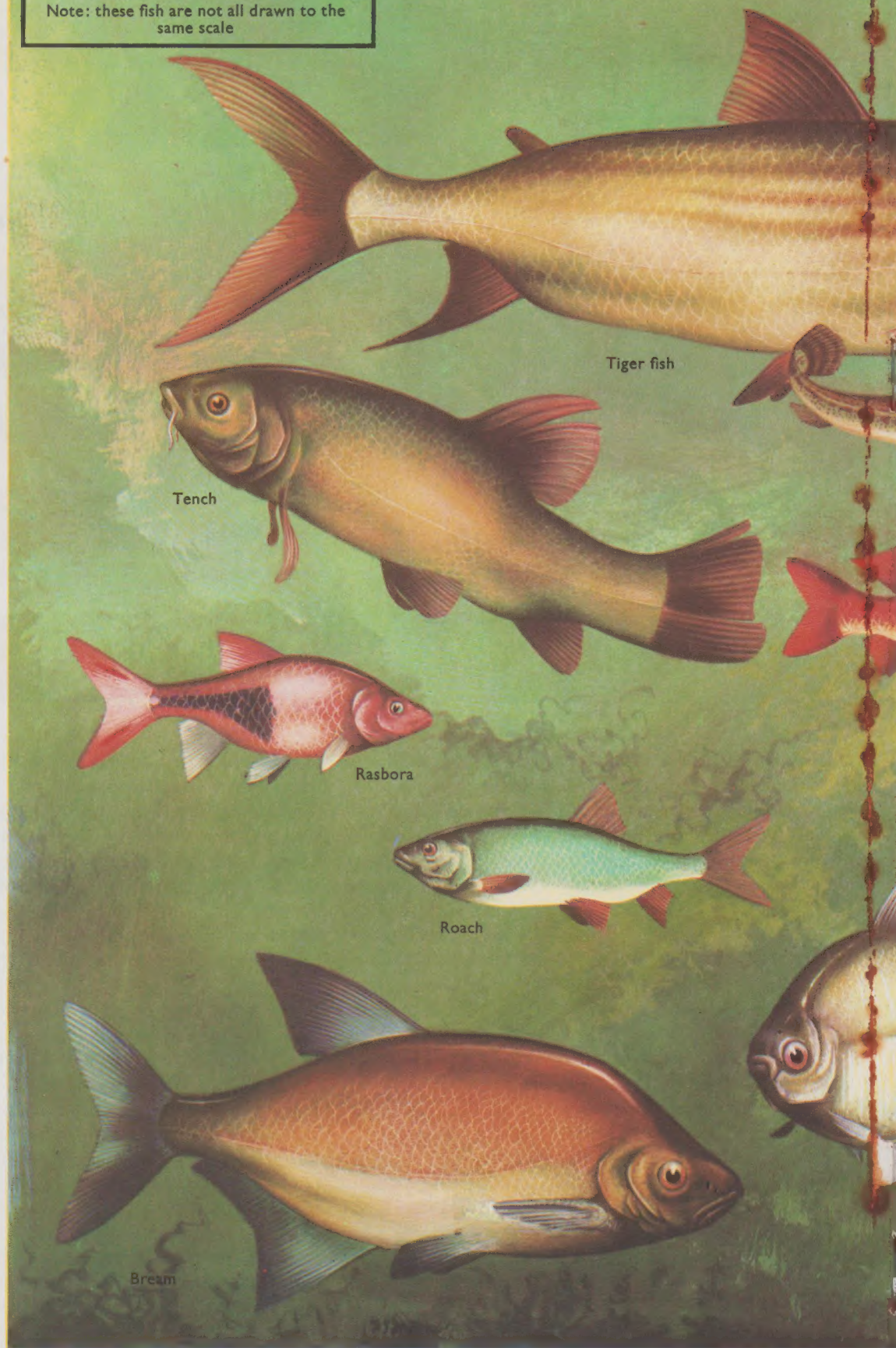
Goldfish (*Carassius auratus*). This is a fish of Chinese origin, and in the wild state is brown in colour. The beautiful gold and red fish we know so well are products of artificial breeding. Goldfish are hardy and live well in small pools, but it is cruel to keep them in little bowls or jars in the house.

Crucian carp (*Carassius carassius*). A European fish that has been introduced into Britain.

Roach (*Rutilus rutilus*). The roach is one of the most common fish. In slow-flowing or still waters where there is plenty of weed it is generally easy to catch, but becomes wary in waters which are constantly fished.

Bream (*Abramis brama*). A sluggish fish that lives near the bottom of still waters such as lakes and canals. Bream often reach 7 pounds. This is perhaps the most common large fresh-water fish in Britain.

Note: these fish are not all drawn to the same scale



A variety of Cypriniform fish, some from the fresh waters of Britain and Europe, some from Africa

FAMILY COBITIDAE

Spined loach (*Cobitis taenia*). This and the **stone loach** (*Nemacheilus barbatula*) are the only loaches found in Britain. They are small, slender fishes, 3 or 4 inches long, and live in streams. They have the curious habit of gulping down air to help them breathe; the oxygen is absorbed through the intestine.

Clown loach (*Botia macracantha*). A native of the Far East which is frequently kept in aquaria.

FAMILY CHARACINIDAE

Piranha (*Serrasalmo rhombeus*). We have already described the habits of this dangerous fish



and South America, and a few which are familiar to us as inhabitants of aquaria

which is found mainly in the Amazon and Orinoco rivers. The piranha only grows to about a foot long, but its protruding jaws and razor-sharp triangular teeth make it formidable. In the water piranha may attack in shoals and inflict severe injuries, and a piranha is also dangerous if caught on a line and pulled into a boat as it bites so fiercely. There are several different species that go under the name 'piranha' and have similar habits; the one illustrated is the most common of them.

Tiger fish (*Hydrocyanus goliath*). This fish is found in the rivers of central Africa and grows to 6 feet in length. Its long, sharp teeth make it extremely dangerous to handle when captured.

Metynnis (*Metynnis schreitmülleri*). A small, silvery fish from South America, sometimes kept in aquaria.

FAMILY GYMNOTIDAE

Electric eel (*Electrophorus electricus*). We have talked about this remarkable fish on page 2935 of this article.

HISTORY OF YUGOSLAVIA

THE state of Yugoslavia came into existence only in 1918. But the peoples from whom most of the modern Yugoslavs are descended – the southern Slavs – came into the area of present-day Yugoslavia in the 7th century A.D. These peoples were the Serbs and the Croats – closely related Slavonic tribes who migrated from the area of the upper Dniester to the shores of the Black Sea and from there to their present home in the Balkan peninsula. For some five centuries after their arrival the Serbs remained a disorganised group of clans, continually at war with one another; they were rarely free of interference from their powerful neighbours, the Bulgarians and the Greeks of the Byzantine Empire. But in the mid-12th century the Serbs united under the Nemnjić dynasty, and from then on they were a major force in the troubled history of the Balkans.

The greatest influence on the Serbs was that of the Eastern Roman, or Byzantine, Empire; for when the Serbs were converted to Christianity they chose to join the Eastern Orthodox Church, of which the spiritual centre was Constantinople, the capital of the Byzantine Empire. The Croats, however, living farther north in Dalmatia and the area between the rivers Sava and Drava, embraced Roman Catholicism. This religious difference has been responsible for much of the subsequent difficulty in creating a united Yugoslavia.

The greatest of the Serbian kings was Stephen Dushan who saw that local rivalries among the Greeks, Bulgarians, and Serbs must be put aside in order to deal with a greater menace – the Ottoman Turks, who threatened to occupy not only the Byzantine Empire but also the whole area of the Balkans. Dushan wished to create a 'Serbo-Greek empire' with himself at its head, and conquered Thessaly, Epirus, Albania, and Macedonia. In 1345 he proclaimed himself 'Emperor of the Serbs and the Greeks'; he was crowned Emperor at Skopje the following year. But his plan to lead the Greeks, Bulgarians, and Serbs in a great crusade against the Turks broke down, for he died unexpectedly in 1355.

Nothing could now stop the Turkish advance. On 15th June 1389 the Serbs were defeated in the great battle of Kosovo. So powerful was the effect of this disaster on the Serbian imagination that folk songs about the battle are still sung in modern Yugoslavia.

Kosovo marked the end of Serbian greatness. In 1459 Serbia was merged finally into the Ottoman Empire. For some 400 years she remained under the Turks who oppressed their subjects with heavy taxes imposed on Christians and the forcible abduction of Christian children to join the military corps of *Janissaries*, who were the backbone of the Turkish rule throughout the empire.



The cruelty and oppression of the Janissaries moved the Serbs to rise in revolt in 1804, under their awe-inspiring leader Karageorge ('Black George'). He was a dealer in pigs and cattle, an enormous, violent, melancholy man who was said to have killed his father and brother. He led the Serbs in their struggle for nine years, and although he was finally beaten and fled across the Danube to seek Russian protection, he had prepared the way for Serbian independence. When Karageorge returned in 1817 he was murdered by his own countrymen, probably at the orders of his rival Milos Obrenović; his head was cut off and sent to the Turkish Sultan. In 1829, after a Russo-Turkish war, Serbia became an autonomous kingdom, ruled first by Milos Obrenović and later by the Karageorgević dynasty (descended from Karageorge). Gradually she won full independence, officially recognised in 1878.

As time passed friction grew between Serbia and her powerful neighbour, Austria, for the Serbs coveted Bosnia which was made a protectorate of Austria under the Treaty of Berlin (1878). Serbia had done well by this treaty, gaining new territory in the south, and she made further territorial gains from the Balkan wars of 1912–1913. But the question of Bosnia still rankled, as most of the inhabitants of Bosnia were Serbs. Serbia and Austria's quarrel led to the First World War; a young Bosnian, acting on Serbian orders, assassinated the Archduke Francis Ferdinand, heir to

the Austro-Hungarian throne, on 28th June 1914 at Sarajevo (see page 1940). Austria and Serbia went to war. Within a short time the conflict spread.

After the war, in 1918, the nation of Yugoslavia was formed out of Serbia, Bosnia, Croatia, Slovenia, Montenegro, and northern Macedonia, with Alexander Karageorgević as king. The official name of Yugoslavia – 'Kingdom of the Slovenes, Croats, and Serbs' – emphasised her chief problem, which was to achieve unity. For the Roman Catholic Croats were suspicious of the central government, dominated by Serbs whose faith was Orthodox. From 1929 until his assassination in 1934 King Alexander ruled as dictator; but neither he nor his successor, Prince Paul (acting as regent for the young King Peter), could unite the Serbs and Croats. The effect of their rule, largely dependent on support from the army, was to drive opposition movements (such as Communism) underground.

In April 1941 the Germans invaded Yugoslavia. The seeds of the modern Yugoslav Communist state were sown during their occupation; for one of the two main resistance movements was Communist controlled, and the power and experience gained during the war enabled this movement to establish a Communist régime in 1944. The Communist resistance group, the 'National Liberation Front' led by Josip Broz Tito, could claim to represent all Yugoslavs in their struggle against Germany. It quickly superseded the other group led by General Mihailović, which operated in Serbia and was suspected of putting Serbian interests before those of the whole nation.

By 1944, when Belgrade was liberated, Tito's resistance army was some 800,000 strong. Inevitably Yugoslavia became a Communist republic, with Tito as President ruling through the army and the police on Soviet Russian lines. But Tito soon showed that he would not be ruled by Moscow. He refused to merge the traditional peasant smallholdings into huge collective farms on the Russian pattern, and was denounced by Moscow in 1948 as a 'traitor to Marxist-Leninist doctrine'. This break with Russia caused Tito to turn to Western Europe and the United States for economic aid, and relations between Yugoslavia and the West improved. Yugoslavia is thus the only 'neutralist' European Communist régime; she has no military alliance with Russia and reserves the right to pursue her own policies independently of both Western and Russian pressures.

CHINESE ART

CHINA'S civilisation is one of the oldest in the world and one of the most unique and fascinating. Among the many things which were invented by the Chinese and which we take for granted today are paper, banknotes, the magnetic compass, silk manufacture, the wheelbarrow, the kite, and the revolving bookcase. It was the Chinese, too, who gave to the world tea, rhubarb, peaches, oranges, pears, roses, and chrysanthemums.

One of the most pleasant ways of learning about the civilisation of this great country is by looking at her art, which developed on its own lines, and influenced the art of Europe in various ways, notably in the 18th century.



Earthenware funerary jar from Pan-Shan, Kansu (from about 2000 to 1500 BC)

The earliest Chinese art

The early centres of civilisation in China were in the north, scattered along and around the course of the Yellow River. By about 2000 BC Neolithic people in Kansu, high up the Yellow River, were making beautiful painted pottery like the urn illustrated above. Lower down the river, a slightly different kind of painted pottery was being made, called Yang Shao after one of the places where it was found, and there is probably some connection between the Yang Shao and Kansu people. In

the provinces near the coast a third kind of pottery was being made. It is known as Lung Shan and is thin and black and polished.

Bronze culture

The Shang people who emerged around 1600 BC knew how to cast bronze for their sacrificial vessels and weapons such as the knife shown on the left. However, in 1027 BC the

Jade knife with bronze socket (Shang period)

Wall-painting in a tomb (Han period)



Bronze dog encrusted with gold and silver (Chou period)

Shang kings were overthrown by the founder of the Chou dynasty. The Chou took over Shang bronze-casting and pottery-making and developed their own style. But from about the 6th century onwards the Chou dynasty began to decay and finally fell, despite the teachings of Confucius and other philosophers about good government.

The unification of China

After much civil war China was united in 221 BC by Ch'in Shih Huang Ti, the first emperor of all China. He standardised Chinese writing and built the Great Wall (see page 2158) which extends for hundreds of miles along China's western frontiers. The names of the most important periods or dynasties since the Ch'in are the Han (206 BC to AD 220, with a break from AD 9 to 23); the T'ang (618 to 906); the Sung (960 to 1279); the Yüan (1280 to 1368); the Ming (1368 to 1644); and the Ch'ing (1644 to 1911).



Sculpture

From early times the best Chinese sculpture was inspired by Buddhism. Men are shown not as they are but as they would like to be; their faces are usually calm and their eyes look inwards, intent on things of the mind. However, there are also carvings of fierce-looking guardian deities.

Many of the earliest Buddhist statues were carved on the inside walls of caves in northern China. Smaller figures were also worked in gilded bronze, and there are many coloured pottery figures of men and horses and other animals which were placed in the tombs of rich people during the Han and T'ang periods.



Detail of a portrait of the Emperor Wen Ti painted on silk by Yen Li-pen (T'ang period)



Buddhist statue in painted marble (Sui period, A.D. 581-618)

Painting

Chinese art found its highest expression in painting which was closely linked with the highly developed art of *calligraphy* or handwriting. An ink-drawing made with a brush forms the foundation of most Chinese paintings. The materials which the Chinese usually painted on were silk or, less frequently, absorbent paper. On the latter especially the artist had to make his brush strokes with great accuracy, because this material permitted no correction or change of mind. Chinese ink came in cakes which had to be carefully ground up with water before being used, and many of the finest painters, especially during the Sung period, used only ink in their paintings. Both ink and colours were water-based: Far Eastern artists did not use oil paint.

At a first glance all Chinese landscape paintings look much alike, but, in fact, they are very varied, and there are many



MINOR ARTS

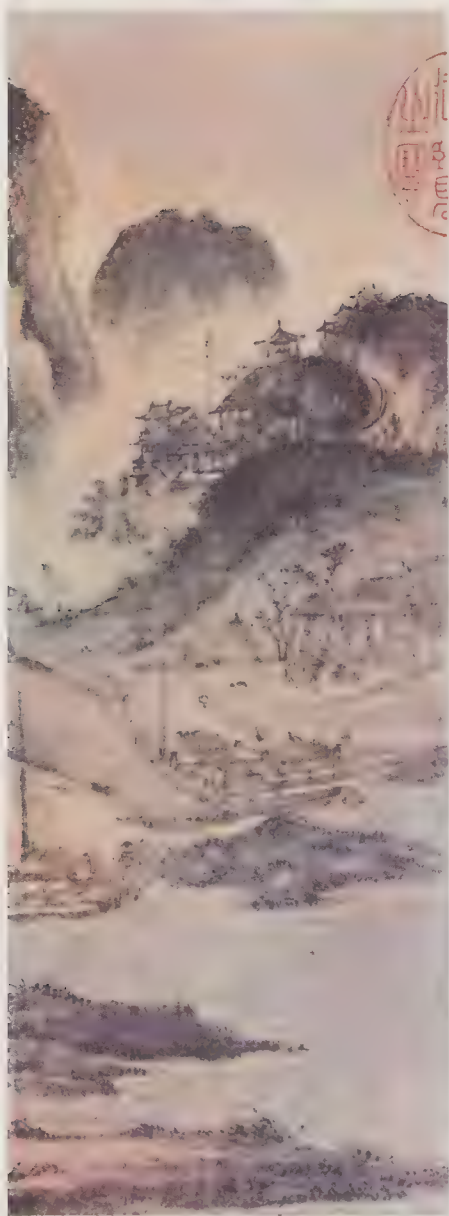
Glazed earthenware tomb figure of a horseman from Astana in central Asia (T'ang period)

Fabulous monster, in jade (Han period)



*'Spring morning in the Imperial Palace during the Han period'.
Painting on silk (Ming period)*

A typical landscape painting on silk (Sung period)



distinct styles. They are usually mounted on rollers, and there are two main kinds – those intended for hanging on walls, and hand-scrolls. The hand-scrolls are unrolled from right to left and are meant to be enjoyed as a story. As you unroll the painting you get the impression that you are actually passing through the mists and mountains of the landscape illustrated.

Man plays an unimportant part in Chinese landscape painting, which is partly an attempt to express the traditional Chinese view of the Universe as a balance of natural forces; but figure subjects and interior views are also common. Another favourite is the 'flower-and-bird' picture, which may be very colourful and decorative.



From left to right: Chün ware bowl (Sung period); ginger jar with blue and white underglaze decoration (Ming period); vase of the type known as 'famille verte' (Ch'ing period); 'famille noire' vase (Ch'ing period)



CERAMICS

The Chinese invented porcelain, a mixture of a special clay and a special stone which after firing is white, translucent, and hard. However, the Chinese word for porcelain also includes the thicker wares of the Sung period. In the Ming period blue and white decoration under the glaze became popular, and during the Ch'ing many kinds of colourful porcelain were made.

MEDITERRANEAN ISLANDS



Geographical position of the Mediterranean islands

THE islands of the Mediterranean are perhaps the most dramatic islands in the world. Their ruins testify to a history-laden past, and their unique, poetic, soul-stirring beauty has fascinated Englishmen from Lord Byron to Lawrence Durrell.

Although they are scattered throughout almost a million square miles of sea, the islands of the Mediterranean have much in common. Most of them are formed of hard, white limestone. Some are completely barren, while others will support only sheep and goats. Once they were forested, but centuries of cutting have reduced the natural vegetation to poor scrub and grass. However, a variety of crops are grown on many of them by means of careful terracing and irrigation. Wheat and barley are the chief cereals, and vegetables,

grapes, and citrus fruit are produced both for home consumption and for export.

Because of their meagre natural resources the islands have long known poverty, and in the last hundred years many people have migrated to the mainland. Recently, however, there has been some increase in prosperity as a result of the growth of the tourist industry. Visitors are attracted by the islands' climate – hot, dry summers and mild, not excessively wet winters; by the beauty of their rugged scenery; and by the aura of antiquity surrounding many of them.

Most of the Mediterranean islands have had a turbulent history and have been controlled by a number of countries. The protected sites of many of their towns reflect the islanders' fear of invasions and piratical raids.

In previous articles we have described several of the islands in detail – Sicily (page 1128), Sardinia (page 654), Cyprus (page 450), and Malta (page 1460).



THE BALEARIC ISLANDS



Majorca, Minorca, Ibiza, Formentera, Cabrera, and a number of small adjacent islets make up the Balearic Islands, a Spanish province with a total area of 1,936 miles.

Majorca, the largest and most important island, is very rugged. Its highest peak, Puig Mayor, rises to 4,741 feet. However, it has fertile lowlands in the south, and cereals and vegetables are grown in fields lined with fruit trees. Minorca is lower and more exposed than Majorca and, like the other small islands, is less developed.

After being in the hands of a succession of conquerors the islands became a province of Aragon in 1343. In 1708 Minorca was captured by England. It was later seized by France but recovered by Spain in 1782.

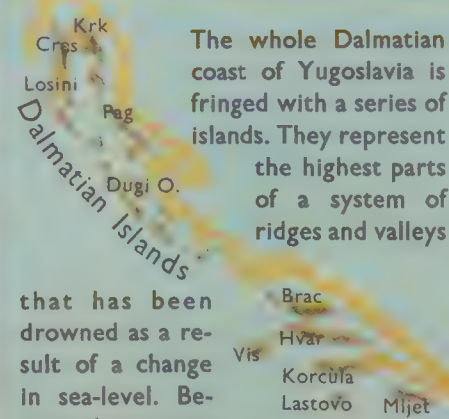
CRETE



Crete, the largest of the Greek islands, lies at the southern limit of the Aegean Sea, 60 miles from the Peloponnesus. It is dominated by a high mountain range which extends from east to west across the island and reaches 8,058 feet at Mount Ida. Farming is mostly limited to small coastal plains hemmed in by limestone ridges and to isolated basins in the mountains. Wine and olive-oil are the chief products, and in higher districts pastoral farming is general. The hard life which they lead has bred a race of tough shepherds on Crete.

The first truly Western civilisation – the Minoan (see page 594) – had its origins on this island, and the ruins of Knossos, a flourishing city in 1500 B.C., can still be seen there.

THE DALMATIAN ISLANDS



The whole Dalmatian coast of Yugoslavia is fringed with a series of islands. They represent the highest parts of a system of ridges and valleys that has been drowned as a result of a change in sea-level. Because they consist of bare limestone, which absorbs all the rainfall, most of the Dalmatian Islands lack a reliable water-supply and are completely barren and uninhabited. However, vines and olives are cultivated on Krk, one of the most northerly islands, and Brač, the largest of the Dalmatian Islands, has fertile soils which support a variety of crops. Goats and sheep are grazed on some of the islands, and a few of the people obtain a livelihood from inshore fishing.

Corsica

Corsica, the birthplace of Napoleon, lies just south of the Gulf of Genoa and is separated from Sardinia by a narrow strait. With an area of 3,367 square miles, it is the fourth largest island of the Mediterranean, but it is one of the least developed. This is to some extent explained by its extremely rugged relief. If you look at the map on the left, you will see that the island consists almost entirely of mountains except for a narrow strip of lowland along its eastern coast.

The lower coastal area has a typically Mediterranean climate, but in higher regions temperatures are lower and the rainfall heavier. The highest parts of the island are covered with snow for six months of the year. Because of its range of climate, Corsica has a variety of trees – oaks, chestnuts, and pines succeed one another with increasing height. However, much of the original forest has now been cut down and is replaced by scrub. Less than 2 per cent of Corsica is under cultivation, and agricultural methods are backward. The chief crops are wheat, grapes, and olives, though sheep and goats usually form the mainstay of the rural economy.

Corsica was occupied by successive waves of Mediterranean conquerors, including Romans and Arabs from North Africa. The Genoese gained possession in 1347. But after four centuries of revolt and internal feuds they sold the island to France in 1768. A strong Bonapartist tradition and anti-Genoese feeling have kept Corsica loyal to France ever since.

Today Corsica forms a Department of France and its capital is Ajaccio, on the western coast. The people, who are strongly individualistic, speak their own Corsican dialect as well as French.

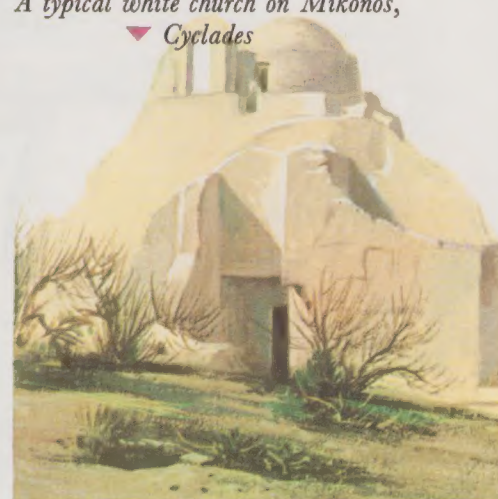


Bonifacio in Corsica has a superb defensive site on a cliff rising sheer from the sea



◀ *The 13th-century cathedral of Palma, Majorca*

A typical white church on Mikonos, Cyclades



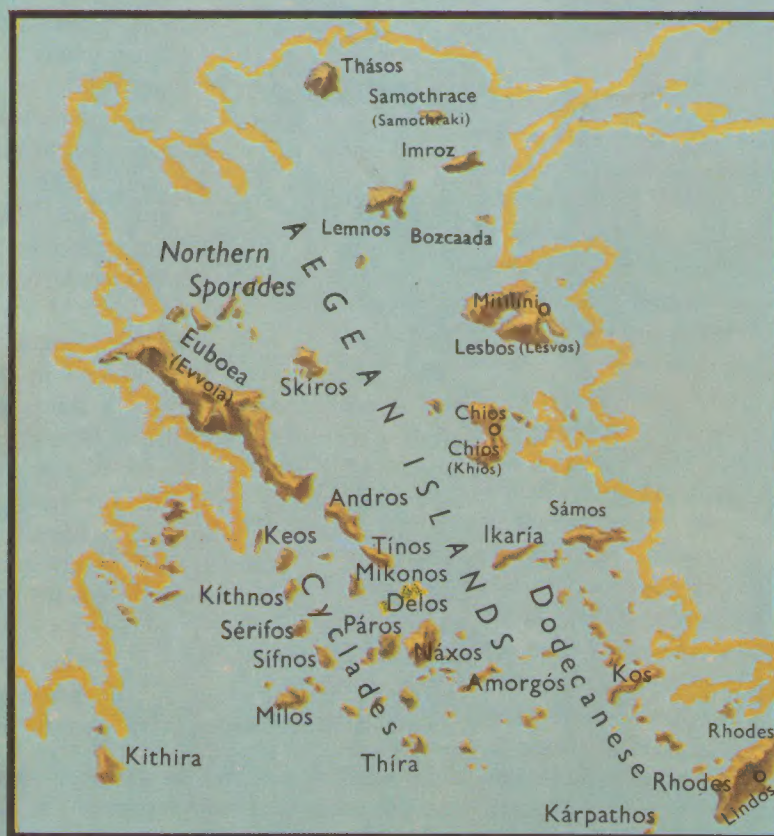
The whole of the Aegean Sea is dotted with islands, most of which are remnants of a drowned land mass, though a few are of volcanic origin. These islands can be divided into: the Aegean Islands proper, including Lemnos, Lesbos, Chios, Ikaria, and Samos; the Dodecanese, including Rhodes; the Cyclades; the Northern Sporades; Euboea, the large island just off the mainland of Greece; the isolated offshore islands, Thasos and Samothrace; and the Turkish islands, Imroz and Bozcaada.

Euboea is very mountainous but has fertile valleys in which wheat, grapes, and olives are grown. Originally independent, the island was conquered by Athens in 506 B C. In 338 it fell to Philip II of Macedon and in 191 B C came under Roman rule. From A D 1351 to 1470 it was one of the most important Venetian possessions in the Levant. It was then captured by Turkey, which held it until 1830 when, after a rebellion, it was incorporated in Greece.

The Cyclades get their name from the Greek word meaning circular, as they encircle the tiny sacred island of Delos. They produce wine, olives, figs, and citrus fruits, and some of them have mineral deposits. In 1000 B C the northern islands of the group were occupied by Ionians and the southern islands by Dorians from Crete. During the Middle Ages most of them were in the Venetian Duchy of the Archipelago, and in 1832 they passed to Greece after almost three centuries of Turkish rule. Delos, dedicated to Apollo from very early times, today contains the ruins of some very fine temples, houses, theatres, and other buildings.

Rhodes, the largest of the Dodecanese, is just 12 miles from Turkey. It is well-watered and forested, and one-third of the island is cultivated. After the death of Alexander the Great (323 B C) Rhodes asserted its independence and entered the period of its greatest prosperity.

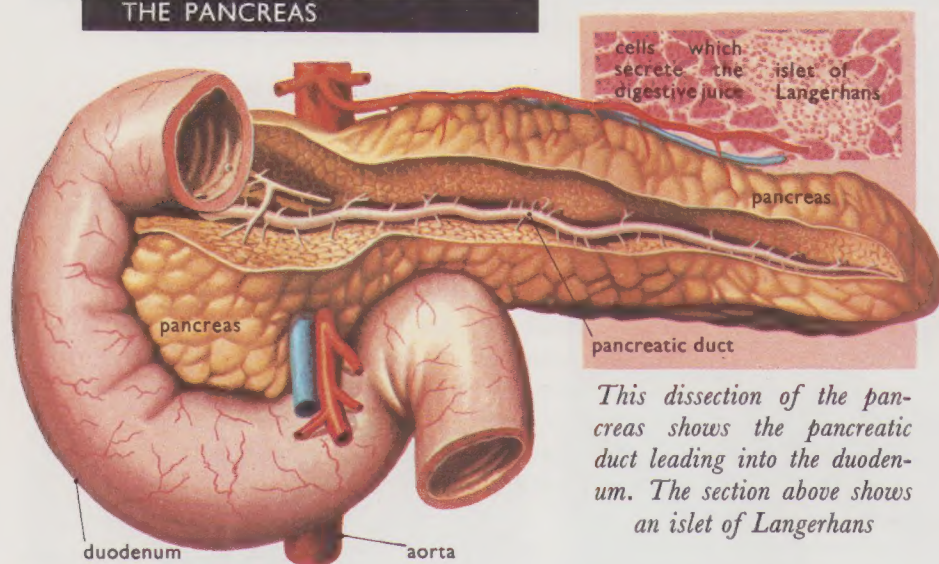
THE AEGEAN ISLANDS



DIABETES

COULD you give up sweets for the rest of your life? You would probably have to if you developed diabetes, for in this illness the body is unable to deal with the sugar from which sweets are chiefly made. What is more, you might have to give yourself a daily hypodermic injection of insulin to enable your tissues to cope with the glucose provided by your diet.

THE PANCREAS



This dissection of the pancreas shows the pancreatic duct leading into the duodenum. The section above shows an islet of Langerhans

CARBOHYDRATE FOODS WHICH ARE CONVERTED INTO GLUCOSE



Diabetes is caused by a partial failure of the *pancreas*, the large gland which lies in the abdominal cavity just behind the stomach. In an adult this gland is 6 inches long and weighs about 4 ounces, and almost all of its tissue is concerned with the production of the pancreatic juice. This fluid, which is secreted by the cells of the pancreas, passes down the *pancreatic duct* into the *duodenum* where it plays a very important part in digestion.

When a fragment of the pancreas is examined under the microscope almost all of it is seen to consist of the cells which secrete pancreatic juice. Here and there, however, little groups of very different cells can be seen. These groups, though so small, are tremendously important. They are the *islets of Langerhans* which make the hormone called *insulin*.

The insulin which is produced in the pancreas is not carried away in a duct, as is the digestive secretion, but diffuses directly into the blood vessels and is carried to the tissues in every part of the body. In the tissues it diffuses into the cells where, in a highly complicated way, it controls the biochemical processes which are involved in the utilisation of the sugar *glucose*. As a result of this control the insulin regulates the rate at which glucose is removed from the blood by the tissue cells and consequently the amount of glucose which is left behind in the blood.

A disease without a cause

Nobody knows why in some people the islets of Langerhans cease to make insulin or, at least, to make enough insulin. Whenever this happens the illness known as diabetes, sugar diabetes, or diabetes mellitus is certain to develop.

The effect of the insulin shortage is to reduce the amount of glucose which the liver and muscles can store as glycogen and the amount which the muscles can burn to form energy. The rate at which glucose is removed from the blood is consequently reduced. However, since starchy foods and sugar in the diet are constantly providing more sugar the amount in the blood increases. When it reaches about double the normal level of 80 milligrams per 100 millilitres of blood, the kidneys are no longer able to retain it and some glucose 'spills over' into the urine. An increased volume of urine is produced to carry away this sugar and this causes the great thirst which is characteristic of untreated diabetes. Furthermore, as sugar is being wasted the patient loses weight. Often this is the symptom which makes someone with diabetes first go to his doctor.

The treatment of diabetes

Since we know that diabetes results from insufficient insulin, its treatment is obvious. First, the diet can be regulated so that it contains very little carbohydrate. In this way the supply of sugar to the body is reduced and the blood glucose level falls. In mild diabetes, particularly in old people, this form of treatment is sometimes all that is necessary.

Secondly, insulin can be supplied to the body by injections, and this method of treatment is used in most moderate and severe cases. Fortunately the insulin does not have to be human insulin; most of the hormone used is made from pig pancreas. Beef insulin is available for the treatment of strict Jews and Muslims who think pigs are unclean. Of course an artificial supply of insulin is not as flexible as the natural supply, and for this reason insulin treatment is always supplemented by a strict diet – a diet which, unfortunately, prohibits the patient from eating sweets.

THE HISTORY OF DIABETES

Diabetes was well known to the Ancient Greeks and it is to them that we are indebted for its name. Diabetes means a siphon through which water runs, and refers to the great thirst of the diabetic and the large volume of his urine. *Mellitus* means honey-sweet, an adjective to describe the sweet taste of diabetic urine.

The discovery that the sweetness of the urine in diabetes is due to the presence of sugar is attributed to the English physician Thomas Willis (1621–1675). The identification of the sugar as glucose, however, was not achieved until many years later.

Insulin was first isolated in 1922 by Sir Frederick Banting, Charles Best, and John Macleod. Many scientists have sought for drugs to take its place which would eliminate the need for daily injections, but it is only in the last decade that any success has been achieved. Such drugs have now come into general use.

SUBSCRIPTIONS

The following magazines can be sent weekly to you, or any person at home or abroad named by you, at the following rates:

KNOWLEDGE £5 4 0
TOUT L'UNIVERS (French Knowledge) £7 16 0

ANNUAL SUBSCRIPTION
DISCOVERING ART
ANIMALS

£9 2 0 (£4 11s. for 6 months)
 £5 4 0

FINDING OUT

£5 4 0

Cheques or postal orders should be crossed and made payable to Knowledge Publications and sent to Subscription Department, Knowledge Publications, 37 Hertford Street, London, W.1.

You should indicate if you wish your subscription to start from the first issue or the current issue. Single copies of back numbers are available at the following prices:

KNOWLEDGE, ANIMALS, FINDING OUT: 2s.

TOUT L'UNIVERS: 3s. 6d.

DISCOVERING ART: 3s. 6d.

All postage and packing paid by us

Sole Distributors
 (Knowledge)

Australia,
 Gordon & Gotch Ltd.
 3/0

New Zealand,
 Gordon & Gotch Ltd.
 2/6

South Africa,
 Central News Agency Ltd.
 27½c

Rhodesias and Nyasaland,
 Kingstons Ltd.
 3/0

India,
 Lalvani Bros.
 Rs 1.60

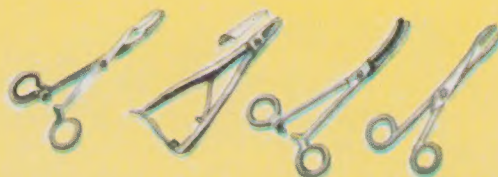
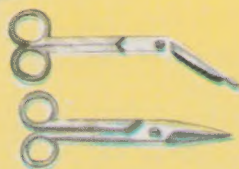
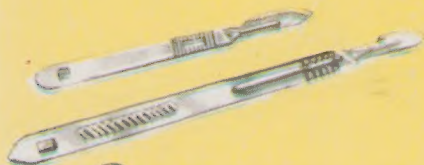
Malaysia,
 Marican & Sons Ltd.,
 Malaya \$1.00

The surgeon's gloves

Although the surgeon, his assistants, and the theatre sister all scrub their hands very thoroughly at the beginning of each operating session, no amount of soap and water will remove all the bacteria from their skin. All of them, therefore, wear gloves of very thin, soft rubber. At one time the gloves were always collected after use, washed, and sterilised again for another day. Now, however, many hospitals find it cheaper to provide their surgeons with disposable rubber gloves which are used once only.

SURGICAL INSTRUMENTS

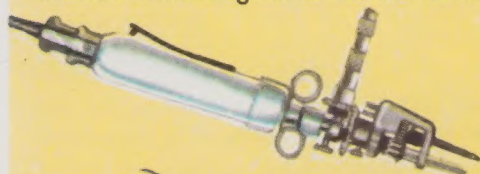
A great profusion of instruments is available to surgeons, but in practice the number used by each surgeon is quite small. Every surgeon has a limited number of 'favourites' which he finds most convenient. On the left are two *scalpels* used for cutting. They have detachable blades which are discarded when they become blunt.



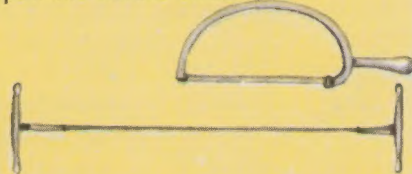
On the left are two pairs of *scissors*, one straight and the other angled. The *forceps* (right) are used to hold pieces of tissue and to stop bleeding.



Retractors such as these are used to keep the skin apart at the operation site and enable the surgeon to see and work upon the tissues underneath.



An electric drill for making holes in bone.



Two types of saw for cutting through bone.

For repairing the wound at the end of an operation the surgeon uses a *needle* and *sutures*. Catgut sutures are used for the deeper layers, and silk or nylon for the skin. Many different types of needle are available, but most surgeons prefer small curved needles which are held in a pair of needle holders.



Sometimes the skin is closed with little metal devices like these *skin clips*. They are removed quite easily with scissors and forceps when the wound has healed.

Note: The illustrations above are not all drawn to the same scale

The practice of surgery

Surgery begins not in the operating theatre but in the surgeon's consulting room or in the hospital out-patients' department. Here the surgeon meets the patient for the first time and decides, sometimes in conjunction with a radiologist, on the nature of his or her illness. This meeting is quite as important as any surgical operation, for the diagnosis of the patient's illness determines the kind of treatment to be given.

Sometimes, of course, it is not possible for the surgeon to make a diagnosis immediately, and the patient may be asked to return another day when the results of some laboratory tests like X-rays and the analysis of specimens are complete. He may even be asked to go into hospital for a few days to be examined more thoroughly than is possible in an out-patients' department.

When the diagnosis of the patient's illness has been made the surgeon has to decide whether or not an operation is likely to be of any benefit. If he decides that it is, the patient is asked to enter hospital as soon as a bed becomes available in an appropriate ward.

The surgical team

A small operation such as the setting of a broken bone or the opening of a boil is a matter of only a few minutes and can be carried out perfectly well by three people – a surgeon, an anaesthetist, and a nurse.

Major operations, particularly those on the chest and the abdomen, need many more people, who, together, are often called a *surgical team*. Usually the more important members of such a team work together for many years and become very familiar with one another's methods and idiosyncrasies.

A surgical team is headed by a *senior surgeon* who usually performs most of the operations. He is assisted at the operating table by his *surgical registrar* and, if the operation is a large one, by his *house surgeon*. The anaesthetic is given by an *anaesthetist* who regularly works with the team and knows exactly how long the senior surgeon takes to perform any particular operation.

Beside the operating table stands the *theatre sister* with her trolleys of sterilised instruments. She hands these to the surgeon one at a time as he needs them. At her quiet beck and call are four or five *theatre nurses* and probably a *theatre orderly*. They arrange the patient on the operating table, bring fresh sterilised instruments if they are needed, collect the used swabs, and pick up anything that may be dropped on the floor. At the end of each operation they clear away all the instruments which have been used and prepare the theatre for the next patient.

Anaesthesia

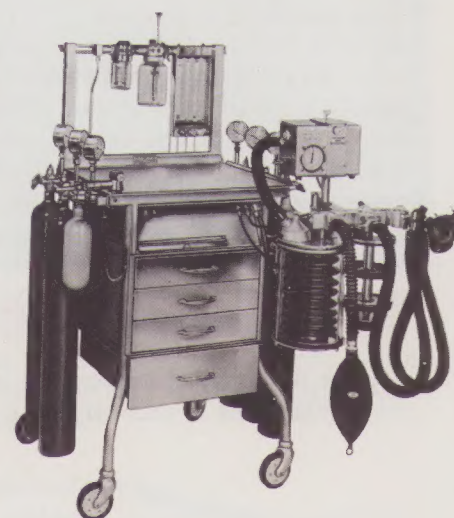
In the early days of surgical anaesthesia the anaesthetics used were the gas nitrous oxide (N_2O) and the two hydrocarbons ethyl ether ($C_2H_5O.C_2H_5$) and chloroform ($CHCl_3$). All three of these had to be administered by inhalation, and because of this the patient was required to breathe them through a mask – an experience which most people find rather unpleasant.

Shortly before the Second World War, however, an anaesthetic was discovered which could be given by injection into a vein. This type of anaesthetic, which is based on barbituric acid, is now used almost invariably at the beginning of anaesthesia, and thus the first stage, known as the *induction*, is no longer unpleasant. It is also easier for the anaesthetist when he is faced with an unusually nervous patient.

The initial anaesthetic is often sufficient for a short operation, but in a longer operation the patient has to be maintained in an anaesthetised condition by the administration of more anaesthetic. Nitrous oxide is still used quite often for this purpose, though it

has been replaced to a considerable extent by two new inhalation anaesthetics, cyclopropane (C_3H_6) and halothane ($CHClBrCF_3$). Muscle-relaxing drugs are often used as well.

Advances in surgery – particularly of the lungs and heart – have greatly increased the complexity of the anaesthetist's work. This is reflected in the machines which anaesthetists now use to relieve their charges of the pain which would otherwise make modern surgery impossible.



A modern anaesthetic apparatus

THE TRAINING OF A SURGEON

Anyone who wants to become a surgeon must have great determination, for the period of training necessary is very long and arduous. It begins at 17 or 18 when the would-be surgeon enters a medical school where, as a medical student, he or she studies for five or six years to become a doctor. When he has passed the Final examination the young doctor takes up residence in a hospital where he works for about three years, first as a *house surgeon* and later on in the more responsible capacity of a *resident surgical officer*. It is during this time that the doctor usually takes the first postgraduate examination in surgery, the Primary Fellowship of the Royal College of Surgeons.

The surgeon then seeks a hospital appointment as a *surgical registrar*, and later as a *senior surgical registrar*. While he is holding these appointments he begins to perform important operations himself, usually under the guidance of his superiors. The holders of registrar appointments are allowed to live at home instead of within the hospital, but, even so, the registrar must remain near to his telephone during the nights and week-ends that he is 'on call'.

Registrar appointments usually last five or six years, and it is during this time that the Fellowship examination of the Royal College of Surgeons is taken. A pass makes the young surgeon a Fellow of the Royal College of Surgeons and enables him to write the prized letters F R C S after his name. It is about this time, also, that other examinations in surgery are taken, particularly Master's degrees which are given by many universities.

By the age of 33 to 35 the senior registrar has reached the stage when he can apply for a post as a *consultant surgeon*. It is then that his teachers can help him more than ever, for they are invariably required to testify both as to his surgical skill and to his acceptability as a person. Success in an interview for such a post can mean a secure, interesting, and rewarding job for the rest of a working lifetime.

IF YOU SHOULD HAVE AN OPERATION

Most people are alarmed at the prospect of an operation, and this is quite natural. No matter how trivial it is, an operation is an unusual experience, and much of what happens is mysterious and difficult to understand. Surgeons, anaesthetists, sisters, and nurses know this well, and they do everything they can to put their patients' minds at rest.

On the day before his operation a patient is usually visited by the anaesthetist, who examines his chest to make sure that all is well with his heart and lungs. A technician from the hospital laboratory may also visit the patient and take a little blood from his arm. In the laboratory this blood is cross-matched with one or two bottles of blood in the blood bank, just in case a blood transfusion is needed.

On the day of the operation the patient has to go without breakfast, because an anaesthetic given to a person with a full stomach sometimes causes him to be sick. Then, about an hour before the operation is due to begin, the patient is given a little injection either in his arm or his leg. It usually contains two drugs, one of which is *morphia* and the other *hyoscine*. The purpose of the morphia is to remove the patient's fear, and this it does quite wonderfully. Within a few minutes of the injection the patient falls asleep, and after that, even if he does wake up again, he does not feel nervous. The hyoscine is to dry up the mucous secretions in the respiratory passages and thus simplify the giving of the anaesthetic. It also acts on the heart and prevents its regular beating from being disturbed by the surgeon's actions.

When all is ready the patient is taken to the little ante-room outside the operating theatre. Here the anaesthetic is started, almost always by an injection into a vein in the arm. Only a tiny pricking sensation is felt before, quite suddenly, the patient loses consciousness completely. When he wakes up again he finds that he is back in his bed once more and that the operation is all over.